SELECTION OF POLICIES FOR MILITARY DEPENDENT PRIMARY MEDICAL CARE DELIVERY SYSTEMS

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THESIS

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ABSTRACT

Some contrasts between civilian and military facility sources of military dependent outpatient medical care sectors of the Uniformed Services Health Benefits Program system are examined. Decreasing the proportion of patient utilization of civilian sources is selected as a system improvement, and increasing military physician accession and retention is seen as a necessary adjunct. Preference as expressed in choice behavior is identified as the proximate mechanism in present utilization patterns and is suggested as a predictor for utilization patterns under alternative policies. A method for assessing preference predictions is proposed and selection of an optimal policy discussed. The procedures developed have continuing applicability for policy selection to meet other goals. Policies that improve the system are seen to have applicability to the current problems in medical care delivery systems at the national level.

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I. INTRODUCTION

Medical care for dependents of military personnel can be considered to be a support function funded by the Department of Defense. As support costs appear to rise in proportion of total military expenditures, additional pressure is felt to increase the efficiency, decrease the cost, or both, of support systems [Binkin, 1972]. In addition, major concern is expressed daily at the increasing cost of and public dissatisfaction with medical care in general in the United States [Schultze, and others, 1972]. Hospitals and hospitalization have been the focus of most studies and concerns [Feldstein, 1971; USDHEW, 1970; etc], probably since costs have risen most dramatically here. Analyses of outpatient care systems have not appeared with anywhere near the frequency of those considering inpatient care systems, possibly because of a general paucity of meaningful data [White, 1973] although a shift in resources from inpatient care to outpatient care is often mentioned as the means of improving the effectiveness of medical care delivery at all levels [White, 1973; Wienerman, 1961; Feldstein, 1973; Knowles, 1973; Saward and Greenlick, 1972].

Recently the Navy's medical care facilities have been reorganized into Navy Regional Medical Centers (NRMC) consisting usually of a large hospital with comprehensive clinical facilities, some smaller and satellite dispensaries at nearby Naval activities, some of which are large enough

to operate limited specialty clinics. Thus all levels of military medical care are represented in an administratively unified system. The military facilities provide part of the outpatient care and most of the inpatient care for military dependents under the Uniformed Services Health Benefits Program (USHBP); the remainder of medical care for military dependents is provided for under the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) as authorized by congress. USHBP is also considered a system defined by common funding and potential users. Dependents of military personnel are free to choose to utilize either military or CHAMPUS-funded medical care sources for each occasion of medical care service.

Choice is seen as the proximate mechanism of operation of the USHBP outpatient care system, at least insofar as the allocation of monetary resources between the civilian and military medical sectors is concerned. Further, choice is considered to be a proximate determinant of the continuing capability of the military medical sector to meet the demands placed on it by controlling the number of military physicians who enter and remain in military service. As these two factors (proportion of utilization of the military medical care sector by patients and military physician retention) are fundamental parameters of the cost and effectiveness of the USHBP outpatient care system, any efforts toward improving the system must treat with them. Thus patient and physician preferences may be given central importance.

Many of the ideas expressed here were encountered or formulated during an experience tour at the Navy Regional Medical Center, Oakland, California, May and June 1973. Statements marked with an asterisk (*) are attributed to the medical and administrative staffs, and were gathered during interviews and discussions.

II. THE PRESENT SYSTEM

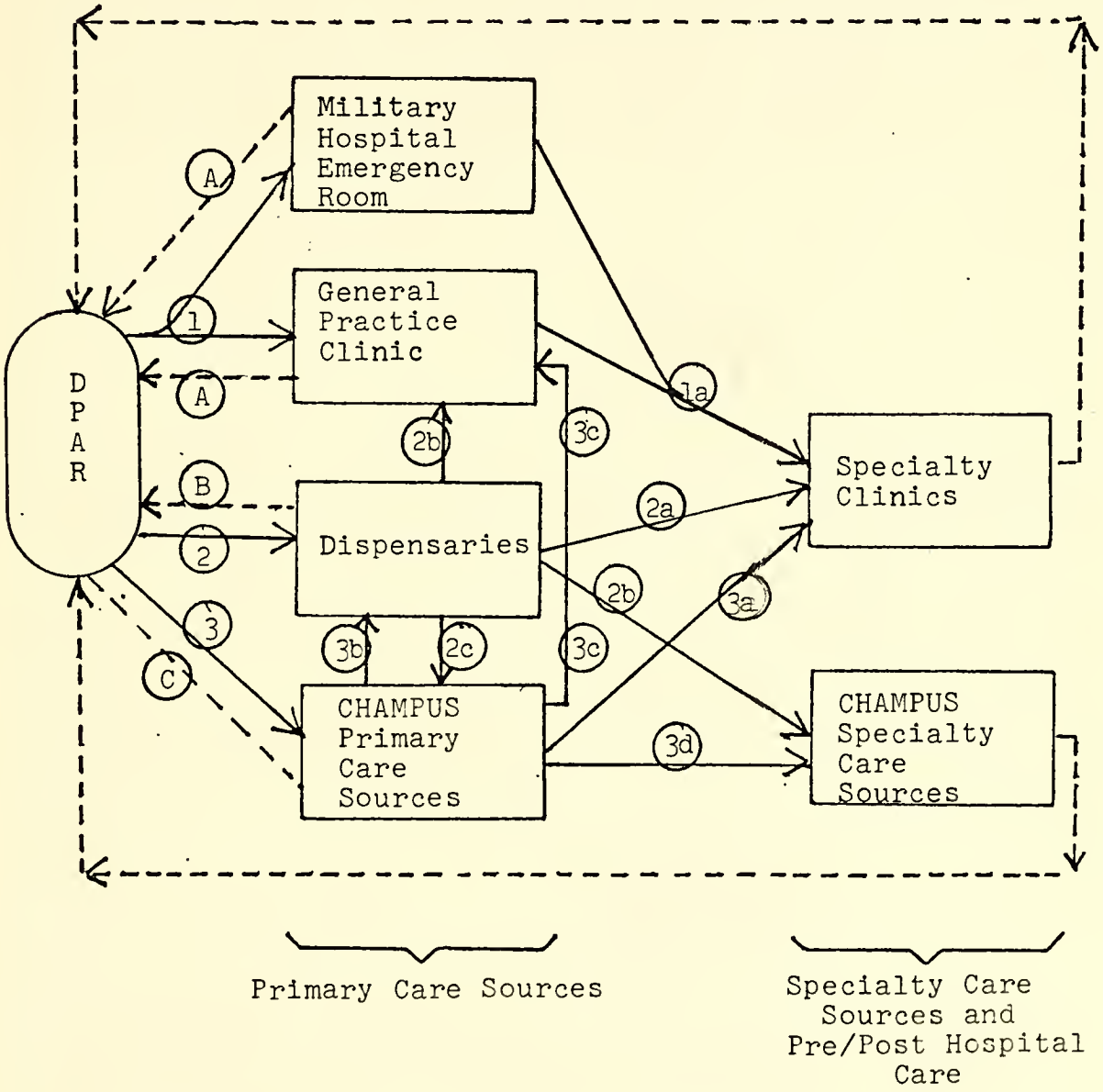
A. DESCRIPTIVE MODEL

1. System Operation

In day-to-day operation, the system manifests itself as the movement of persons seeking medical services among medical facilities of various kinds. The persons providing the services are shown as part of the facilities. Military dependents seeking medical services will be called patients; providers of medical assistance will be called physicians. Changes in the use of paramedical personnel either to increase the effectiveness of physicians employed or to act in a flow regulating capacity [Garfield, in Chacko, 1971] are not discussed. Several pilot programs are now in effect to test the practicability of utilizing paramedical personnel in a role of increased responsibility. It is felt that successful expansion of these programs will probably have beneficial effects on the objectives independent of the policy choice considerations to be discussed. DPAR refers to dependent population at risk, the patient source.

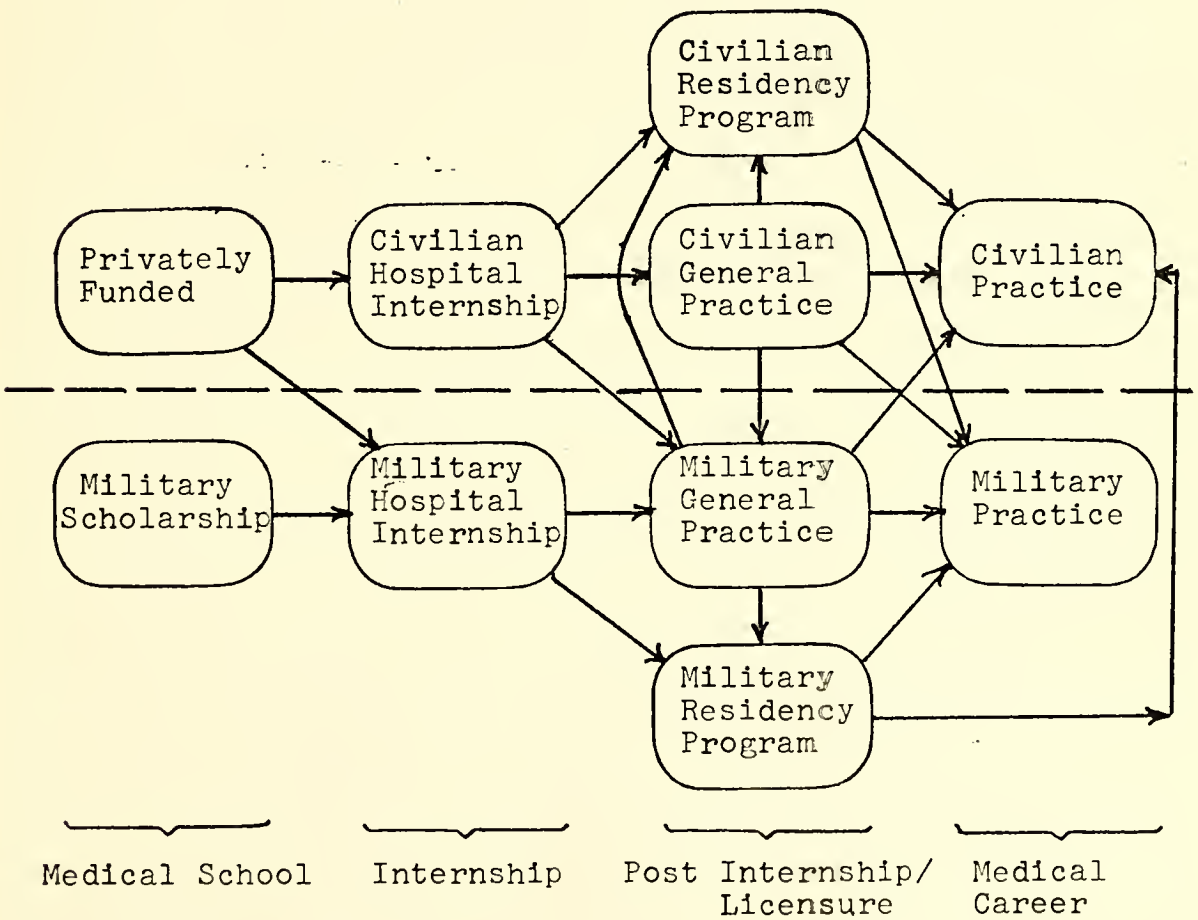
Dissatisfaction has been expressed (for example at Oakland NRMC) at the existence of patient movements between primary care sources in the course of seeking the solution of a particular medical service (especially route 2b) and what is deemed excessive use of routes 1a, 2a, 2b instead

of routes A and B; i.e. primary care sources tend to function as referral services in excess and are deficient in actual provision of care. (*)



2. Physician Accession and Employment

Difficulty has been encountered in providing sufficient numbers of physicians to provide primary care in dispensaries and General Practice clinics, for example during the summer of 1973 at Oakland Navy Regional Medical Center, and during the fall of 1973 at the Naval Postgraduate School Dispensary. Thus the actual provision of services is not well represented as a fixed facility. A partial chart of possible physician employment paths is represented:



Of interest are: routes that cross from above the broken line to below it (accessions to military medical service) routes that remain below the broken line (retentions) and routes that cross the broken line from below to above (losses by military medical service).

B. THE OBJECTIVE AND ASSUMPTIONS

1. Utilization of CHAMPUS and Military Medical Sources: The Problem

Both CHAMPUS disbursements and all operating costs of a Navy Regional Medical Center (including outlying dispensaries) come out of a fixed budget. (*) CHAMPUS disbursements may account for more than half of the total budget allocation (for example at Oakland NRMC in FY 72, as reported by the Administrative staff). CHAMPUS is "open-ended"; that is, there is essentially no restriction on the number of services a patient may elect, and the CHAMPUS disbursement for each service is fixed by the local CHAMPUS administrative agency (Blue Cross, in California). Thus heavy utilization of CHAMPUS sources of care by patients reduces funds available for military facility operations in an essentially uncontrollable fashion. No present means exist to reduce the incidence of CHAMPUS utilization except to provide what would be perceived by patients as superior medical services in the military facilities. The patient may commonly lump these obstacles under the descriptions "inconvenience" and "indifference." Although the patient must pay at least $50.00 per year plus 20% of the service fee to utilize CHAMPUS

sources, he evidently often perceives it to be worth the cost to avoid the inconvenience and indifference.

2. Provision of Services

A general desire to avoid serving in a primary care capacity was perceived to exist among staff at the Oakland NRMC (among other places). It was difficult to determine whether this was a cause or an effect of the usual practice of assigning nearly all non-career medical officers designations as General Medical Officers (GMO) and utilizing them in primary care billets. The results were low retention of physicians serving in a full-time primary care capacity and insufficient numbers of physicians serving in this capacity, leading to excessive patient waiting times and a strong tendency towards hasty service and excessive numbers of unnecessary referrals to specialty clinics. (*) To summarize, the problem is to find means to attract patients away from CHAMPUS medical care sources by providing medical care services at military facilities that are perceived by patients to have net superiority in quality. The major accompanying problem is to attract, retain, and organize sufficient numbers of military physicians to provide these preferred primary medical care services. In terms of optimization, the objectives are the proportion of total USHBP services performed in military facilities, and the availability of military physicians to perform those services. The problem is to choose a policy alternative most likely to maximize the objectives, subject to identifiable constraints.

3. Assumptions

(a) The CHAMPUS program will continue to be available in its present form.

(b) The marginal cost of providing increased levels of military medical services will be no more than the CHAMPUS disbursement for the equivalent services provided by civilian sources. (Note that this need not be an assumption; it is commonly considered to be fact among knowledgeable Medical Service Corps Officers queried at Oakland NRMC. However, a specific investigation is outside the scope of this thesis.)

(c) The present NRMC command and administrative structure will continue in effect.

(d) The budgeting concept and procedure for medical services will remain in effect and will not experience substantial increases or decreases in size.

(e) Implementation of a National Health Insurance Plan and trends toward increasing control of cost and methods of practice in the civilian sector will not lead to full-time contract of civilian sources to provide military medical care, and military medical facilities will remain under direct military control.

(f) It is desirable to decrease CHAMPUS utilization and increase military medical facility usage proportionately. (This is equivalent to assuming that the problem as stated is valid. This further assumes that there are no unknown but compelling reasons that override the justifications for

the statement and interpretation of the objective and that the desired increase in physician retention can be accomplished without exceeding relevant manpower ceilings. That the objective is valid is supported by the Commanding Officer, Oakland Navy Regional Medical Center and his staff, (May 1973); however it is imagined that legislative authorities might feel otherwise.)

(g) Family Practice residencies can be established in NRMC and the existing trend toward increasing numbers of medical school graduates desiring careers in Family Practice medicine will continue [Los Angeles Times News Service, 3 February 1974].

C. SOME RELEVANT CONTRASTS IN CIVILIAN AND MILITARY MEDICAL CARE SECTORS

1. Contrasts in CHAMPUS and Military Medical Care

(a) Inconvenience and long waits: civilian sources invariably utilize an appointment system while military sources often utilize queueing as a patient flow scheme, without appointments.

(b) Choice of physician and continuity: the patient is free to choose his physician under CHAMPUS. In a military facility, he often has only the choice of seeing the physician on duty. Thus repeat visits for further treatment are not necessarily to the same physician.

(c) Availability of care (emergency): CHAMPUS sources can usually be contacted directly by patients during off-hours and the patient can usually arrange to meet his

physician in the physician's office if the situation warrants it. Patients usually find it very difficult to reach the military physician on call during off-hours; the patient has no choice of whom he may eventually reach, and may have to resort to use of the nearest military hospital emergency room, usually with its very long queues.

(d) Preventive medicine: CHAMPUS does not reimburse costs of preventive medical services. But military facilities do not offer preventive medical services to dependents except in the form of "well-baby clinic", annual pap smears, and pelvic examination for female dependents.

(e) Costs: CHAMPUS co-payments consist in the first $50.00 per individual or $100.00 per family each fiscal year plus 20% or 25% of "allowed" fees. Military facility outpatient care is free of direct charge although it might be argued that there are other economic costs that are substantial (excessive waits [Campbell, 1971; Whipple, 1974]; the perception of inferior services; baby-sitting fees, as well children are not allowed to accompany parents, etc.).

2. Contrasts in Civilian and Military Physician Employment

(a) Pay systems and stability (fee-for-service versus salary): military pays to physicians (including continuation pays) are usually somewhat lower than for comparable salaried civilian positions, and may be substantially lower than remuneration in a fee-for-service practice. However fee-for-service net remuneration to a physician is

frequently lower than salary for comparable civilian positions [Roemer, 1962]. The salary does represent much more secure and stable an income. Present trends indicate a steady rise in the proportion of physicians in the United States who are salaried [Harris, 1964].

(b) Continuity of care: the civilian physician is usually kept informed of his patient's progress and can continue to participate in his health care in the event of referrals or hospitalization. This is seldom the case in NRMC.

(c) Workload and hours; emergency calls: the civilian physician usually works longer hours (approximately in proportion to his greater remuneration) than the military physician. The military physician generally is not assigned or associated with specific patients so that he responds to after-hours calls only when he is assigned standby duty.

(d) Preventive medicine: the military physician provides some preventive medical services to active duty military personnel, but it is not integrated into an ongoing program of health maintenance. The civilian physician generally does not have patients motivated to pay for such a program of health maintenance except when both are members of a Health Maintenance Organization (HMO) such as Kaiser-Permanente or the Health Insurance Plan of Greater New York (HIP).

(e) Specialization Opportunities: the military physician enjoys at least as great an opportunity for

specialist training (residency) as his civilian counterpart and is usually much better remunerated during it. (*) However the military physician probably has less choice of which specialty to train for.

(f) Choice of domicile, family separation: the military physician may be subject to transfers and change of domicile every few years, and although he may have relatively free choice among duty stations, the alternatives available are limited to military facility locations. Further, occasional tours of sea duty cause a few physicians in the military services to be absent from their families for extended periods.

(g) Professional freedom: the military physician enjoys about the same level of professional freedom as any member of a large group practice (*) (although this may be hotly contested). The review boards and other professional constraints that are likely eventually to follow National Health Insurance implementation will almost surely mean that the military physician enjoys at least as much professional freedom as he would in any civilian practice.

(h) Administrative burden: on balance the military physician is required to perform less record keeping and other paperwork than his civilian counterpart, especially with the growth of civilian and government health insurance coverage and its administrative requirements.

(i) Required occasional assignment in a primary care capacity: the military physician who retains his

designation as a GMO will almost certainly serve in a primary care capacity during his entire career; the military physician who specializes provides primary care only when the referral system is abused by overburdened GMOs or on a part-time basis during shortages of GMOs. The civilian physician is in somewhat the same position except that if he specializes he may elect not to act in a primary care capacity at all.

3. Other Attributes

Several other possibilities present themselves which are not considered relevant in direct preference assessment because they are possible of implementation regardless of primary care facilitative policy changes, and their benefits either to physicians or patients may not be directly evident.

III. INFERENCE

A. NATURE OF THE OBJECTIVES

In order to realize improvement in the objective, patients and physicians must change their economic behavior in the aggregate. Since free choice of the source of care is assumed to continue and since physician accession and retention is largely a matter of individual physician choice, improvement in the objective can be accomplished only by increasing the attractiveness of military medical care systems to patients and physicians. Further, since the alternatives to military medical care systems are civilian medical care systems, it would be appropriate to examine attributes of civilian medical care systems for possible implementation in military medical care systems to effect the desired increase in attractiveness. Finally, it would be appropriate to test attributes not generally implemented in civilian medical care systems which could be implemented in military medical care systems to effect an improvement in the objectives. Any particular combination of attributes will be called a policy.

B. INFERENCE FROM EXISTING DATA

1. CHAMPUS Data

The data recorded consist primarily in utilization and cost information. Included are patient address, sponsor duty station (where, presumably, military medical facilities which were not utilized are located), location of source of

care, kind of service provided and charges allowed. Not included are actual costs to patient if the source of care is a "non-participant" (i.e. does not adhere to the fee schedule specified by the fiscal agency for reimbursement computation), why the patient chose CHAMPUS over military facilities, and the type of organization of the source of care (solo, small groups, clinic, or HMO). Because of highly variable delays encountered in processing CHAMPUS claims, there may be substantial inaccuracies in summaries over short time spans. Further, little information is available concerning the patients' frequency of use of military medical care facilities and referrals to other civilian or military medical care sources.

2. Military Facilities Utilization

These data consist directly in utilization information. Cost data are not based on charge for individual services rendered; in fact it is difficult to impute the proportion of facility cost allocable to a particular service, or to determine if provision of services to military dependents is more costly than provision of services to military personnel. Data do not include complete referral information (to other military or civilian facilities) or if individual patients utilize civilian sources as well as military sources of care, or in what proportion. Confounding of several types occurs, as well, especially at the dispensary level. If physicians are available for primary care duties who have had specialty training, the incidence of service

related to their specialties reported by that dispensary will tend to increase during their tours of duty (Administration Officer, Naval Postgraduate School Dispensary, Winter 1973). After their departures, presumably the users of their specialty services will seek the equivalent care elsewhere, either through CHAMPUS or at another military facility. The availability of such specialized services at the primary care level is difficult to predict, and it tends to bias basic data describing primary care delivery. Another type of confounding may be described as local policy variations. Appointment systems and their modes of operation; referral services; resources and effort directed specifically at dependent care; working relations with the local civilian medical community; hours of availability of various services; and many other factors are under the control of the facility Senior Medical Officer. As many of the policies and effects are implemented informally, attempting to determine the effects of various local policies or even what some of them were may be virtually indistinguishable from determining the effectiveness and capability of individual Senior Medical Officers. Such an investigation would expect to be met with great resentment and results could quite reasonably be regarded as unacceptable for any further use by military medical staffs. In short, there are no data concerning the effects on patient choice behavior of reducing the contrasts in attributes in CHAMPUS and military medical programs except possibly for the effects of instituting an appointments system.

3. Physician Accession and Retention

These data are available primarily in gross form; that is without identification of variables that could be correlated with individual circumstances. Thus the effects of local policy factors on retention cannot be determined readily; and the relation between individual physician opportunities for further training as a civilian or in military medicine, or duty assignment, and his retention decision cannot be determined. The recent existence of the "doctor draft" confounds accession data considerably. In short, no reliable data exist with which to predict the effects of various relevant policy alternatives on accession and retention.

C. PRESCRIPTIVE INFERENCE

1. General

A particular policy is implemented presumably because it will (or is expected to) effect some kind of improvement; the choice of policy for implementation is presumably based on its capability or expectation of effecting more improvement than any other. In the case of USHBP competing sectors have been identified as CHAMPUS and military medical care facilities and improvements desired described as decreasing CHAMPUS utilization by increasing military medical care facilities' utilization, and increasing military physician availability in a primary care role.

2. Predictions

Implementing various of the policies in various locations on a trial basis in order to test their relative effectiveness in improving the system is not an ideal procedure. First, the administrative turbulence and expense resulting from transient policy implementation would be undesirable; second, the test period would have to be on the order of several years to begin to test the effects on physician accession and retention; third, local effects and the knowledge by participants that the policies may be transient could be expected to confound any results. Unfortunately, so-called experiments of nature do not exist with regard to the policy alternatives (attribute contrasts) which are formulated here, so that existing data can be used to predict exact future behavior of the participants in the system only under the policies which are now in effect. The objectives to be improved have been formulated in terms of aggregate choice behavior. It would seem reasonable, then, to attempt to measure the aggregate preferences of patients and physicians for various of the policy alternatives. It is to be expected that the feasible policy which is somehow most preferred both by patients and physicians will be the policy which will result in the greatest improvement in the objectives within existing budget constraints.

a. Contrasts in Choice Revocability

Some difficulty is encountered in comparing patient and physician preferences. Patient choices are

frequent and repeated; a patient is not committed to make a future choice by his previous choice. On the other hand, the choices a physician makes that are relevant to the considerations here (entry into or retention in military service) are not repeated and are essentially irrevocable: to enter military service or not; to remain in service or not at the end of active obligated service. Thus in considering a choice or predicting his preference for it, a patient has some past experience to draw on and can always change his mind later. The physician has neither past experience nor the opportunity for remaking the same decision.

b. Competition for Resources

When considering the system as a whole, it appears that the civilian sector (CHAMPUS) is competing with military facilities for funds, patients, and physicians. However, neither sector of the system has an identity in terms of motivated behavior. The principals involved (patients and physicians) are in a sense the resources being competed for rather than being the competitors. Thus a conventional resource allocation formulation is not appropriate.

IV. ALTERNATIVES AND COMPARISONS

A. ALTERNATIVES

1. Technical Facilitative Changes

These are not policies under consideration as they are generally agreed upon as desirable improvements independent of direct effects on patient and physician preference behavior; they do not represent compromise between patient and physician desires in the aggregate, and are essentially procedures designed to increase system efficiency. Obstacles to implementation are variously the associated costs and incomplete administrative control of outlying facilities in the relatively recently-established NRMC concept.

a. Referrals

It was observed that referrals tended to be excessive in number (that is, too many services could have been provided at primary care levels of military medical care facilities) and sometimes were misdirected (that is, patients were referred from one facility to another at the primary care level). (*) Reducing the incidence of inappropriate referrals is (at least in theory) possible by administrative action that may be instituted by the NRMC Commanding Officer consisting in policy directives and to some extent, reallocation of physician manpower to increase availability of primary care sources. Since the various components of the NRMC enjoyed considerable autonomy prior to organization into a NRMC, there has been some reluctance to impose closer

administrative control (especially if the control concerns modality of practice of medicine in any way). Nevertheless the authority to effect improvements exists. (It is noted that the CHAMPUS system effectively prevents excessive referrals to hospitalization, as civilian hospitalization is covered under CHAMPUS only if it is both considered necessary by military medical authorities and is unavailable in local military hospitals. Thus the costly abuse of hospitalization caused by fee-for-service third-party modes of medical care delivery noted by Roemer [1962] and others is effectively prevented.)

b. Medical Data Systems

The present system used to store and retrieve patient histories and treatments is awkward at best. A number of proposals are under consideration which promise to reduce reliance on handwritten or transcribed records which must be retrieved from files at the patient's principal primary care facility for use at that facility, and which must be carried by the patient to another facility if consultation or testing is required. Methods of incorporating patient data created by civilian medical care sources into military facility records are also under consideration. Costs and need for hardware standardization decisions are the obstacles to implementation. (*)

c. Casemix Planning

Feldstein [1968] developed a linear programming algorithm for planning specialty clinic consultation periods

which smoothed workload in auxiliary service facilities (laboratory; radiology; patient admitting; etc.) in the British National Health System facilities. A "circuit rider" visiting clinician concept has been incorporated from time to time between NRMC central and outlying facilities. Provision of some features of preventive medical practice (such as physical examinations) could be provided to patients (that is, to those who are not active duty service members) in some variation of the "Prosser plan" [TIME magazine, 11 February 1974]. Feldstein's linear programming algorithm or the like could greatly facilitate preventive medical practice planning, clinician visits, and so on, to avoid cyclic overload of various types of service. The advantages of using all available facilities to capacity are well documented and discussed in virtually every text on hospital administration.

2. Primary Care as a Specialty

A major deficiency in military medical care systems is inadequate or inconvenient provision of primary care and overemphasis of specialty care. (*); [White, 1973] This is evidenced by: overuse of emergency room facilities at military hospitals (*), [Strauss, 1967]; excessive queueing times [Whipple, 1974]; heavy utilization of CHAMPUS despite its additional cost (*); the tendency to view opportunity for specialization as a primary military medical career incentive to the degradation in status of the providers of primary care (*); and so on. It has been observed that the

overemphasis on specialty care (and corresponding neglect of primary care) is characteristic of American medical practice in general yet in Great Britain the reverse is true [White, 1973]. As the organization of military medical care systems more closely resembles the British National Health Service one could expect that the factors tending to de-emphasize specialty care in Great Britain would do so in military medical practice. The limiting factor in Great Britain is number of specialty practice positions available; a substantial majority of physicians entering American military medical service possess some degree of qualification as specialists. It is appropriate to conclude that military medical practice reflects quite accurately the practice prevalent in this country as a whole. The relative success of Health Maintenance Organizations at shifting a large proportion of health care expenses from inpatient and highly specialized treatment to primary care providers [White, 1973; Chacko, 1969; etc.] could be taken as an incentive to military medical care planners to emulate them. (Recent reports have been made of trends toward critically excessive utilization of these primary care sources [Garfield, in Chacko, 1971]; the solution suggested relies heavily on expansion of the roles of paramedical personnel to include some of the more routine functions of primary care physicians. Strong resistance to much of this may be encountered in the civilian medical community [Board of Medical Examiners, State of California, 1973; White, 1973]. The existence

of pilot programs and some past practices in military facilities similar to those referred to indicates that an unique opportunity exists in the military medical community to develop such solutions independent of the policy choices considered here.) The increasing numbers of medical school graduates desiring careers in primary care medical practice [Los Angeles Times News Service, 3 February 1974; Ebert, 1973] could promise an increase in willing providers of primary care in military medicine if adequate inducements were offered. Until recently, however, primary care was generally viewed as the province of those physicians not qualified to provide more diagnoses and treatment. (*) The establishment of the Academy of Family Practice and development of Family Practice residencies promises to improve the status of the providers of primary care if only by establishing primary care as a specialty in its own right. Opportunities for recent medical school graduates in Certified Family Practice residencies are quite limited, however [Ebert, 1973]. (Rex Whitworth, M.D., Director of Education, Natividad Medical Center, Salinas, California, has indicated that difficulty in obtaining certification for such residency programs, especially in the typically smaller civilian hospitals, is a factor in this restricted opportunity.) It is apparent that establishment of a vigorous Family Practice residency program in military hospitals could be used as an accession and retention inducement. Because of military hospital size and other well-established and reputable

military residency programs additional Family Practice residency certifications should not be difficult to achieve.

It should be noted that the USHBP is referred to in both its military and civilian components as "medical care programs" rather than "health care programs". This is because preventive medical practice is not well provided for. It has been noted [Campbell, 1971] that in some health care delivery systems where annual physical examinations were provided as part of a prepaid program, the utilization rate of physical examination services was only about 30%. The requirement for active duty military personnel to undergo regular physical examinations would likely influence greater utilization by dependents if such services were made available. As preventive medical services are ostensibly fundamental to Family Practice medicine [Saward, 1969], making preventive medical services available to dependents in military medical facilities could be a significant inducement to decreased utilization of CHAMPUS sources of primary care.

The idea of dealing with the family unit as a whole is another fundamental principle of Family Practice medicine. In order to accomplish this, it would be necessary to enable the patient to see the same physician at each visit, thus providing continuity of care. Technical means of providing information feedback from specialty referrals would help as well. An element of successful Family Practice medicine is some sort of rapport between patient and physician [White, 1973]; it is not difficult to appreciate that it is essential

that the patient be allowed free choice of physician to facilitate this rapport (at least within limits of physician availability).

"Indifference" has been used to describe patient assessment of physician attitude in a number of settings including fee-for-service group practice [Wienerman, 1968], among salaried physicians in Health Maintenance Organizations and prepaid group practices [Kracke, 1950; Field, 1961; Roemer, 1962]. Thus this is probably less an inherent factor in contrasts between CHAMPUS and military medical care sources than might be supposed. In fact, the perception of indifference in physicians was implied to be closely related to the leadership efforts and morale facilitated by the local Senior Medical Officers in dispensaries surveyed by Capt. J. Davis, MC, USN in 1972 (Enclosure to Chief of Medicine Memorandum to the Commanding Officer, Oakland Naval Hospital, 4 October 1972). Thus the "human element" of the feelings patients have about physicians is seen to be more a matter of individual differences and (in military medical care facilities) environment established by the Senior Medical Officer. These local differences could even dominate any changes in preference for military medical care sources due to policy changes as advanced here.

Obtaining military medical services desired outside normal working hours is a problem: the only source is usually the emergency room of the nearest military hospital (generally entailing several hours' wait) unless the patient

can convince the Corpsman on duty at the dispensary that the situation is sufficiently grave to warrant the attention of the physician on call. The patient is not afforded the opportunity to contact the physician directly. In contrast, CHAMPUS medical care sources usually are available either directly or as one of a small group (four or fewer) who share responsibility for dealing with off-hours medical care needs. Thus the availability of a primary care physician known to the patient at times other than office hours is an advantage enjoyed primarily by the CHAMPUS user.

3. Supply and Demand of Services

USHBP can be considered to be in equilibrium; the patients are able to secure medical care at a net cost not usually considered unreasonable (either through CHAMPUS co-payment or imputed costs of inconvenience); enough physicians are retained in military service to operate existing facilities; and the total costs do not exceed budgets excessively. (*) A decrease in physician retention would (and has) increase military facility patient inconvenience sufficiently to induce a higher proportion of patients to choose CHAMPUS medical care sources (and more instances of non-availability of hospital services would occur, with CHAMPUS benefits extended to hospitalization). Thus the total number of services demanded remains relatively constant under the present choice-of-price system (*), although it is likely that total costs would rise if there were a substantial decrease in the number of military physicians. (The marginal

cost to the government per patient visit of increased CHAMPUS usage is the same as the average cost since constant fee-for-service is the reimbursement mechanism, and administrative costs to the government of CHAMPUS are proportional to fees paid. Because of the existence of fixed costs or overhead at military medical facilities the reduction in costs due to a reduced number of military physicians employed, hence fewer patient visits to military facilities, would be less than proportional to the reduction in patient visits, or average cost per patient visit would increase. Despite the fact that the entire system is highly labor-intensive [White, 1973] the fixed costs cannot be disregarded.) Although open to some question, stated military medical facility average costs are typically lower than comparable civilian facilities (as for example was determined by GAO audit of Oakland Naval Hospital, 1972). Conversely, increasing the numbers of military physicians can be expected to reduce total program cost, at least if the increase is not large. Feldstein [1968] found that in Great Britain, the supply elasticity of demand for medical services was about 0.9; that is, demand increased almost exactly as supply. (Imputable queueing costs are a patient demand factor in Great Britain.) An increase in military physician availability would tend to reduce queueing ("inconvenience") costs in military facilities, and an increase in realized demand on military facilities would be experienced. Just how much of this utilization increase would represent a shift from

CHAMPUS utilization and how much would represent increase in total demand realization is uncertain. Because marginal costs of CHAMPUS services would remain the same to the patient, the utilization of CHAMPUS services would not increase and would almost certainly decrease in favor of military medical facilities utilization until a new imputed queueing cost equilibrium was established. In fact, since the initial co-payment under CHAMPUS each fiscal year is the full fee-for-service (interpretable as a yearly start-up cost, and fixed) it would be reasonable to expect a sharp drop in CHAMPUS utilization at the beginning of the fiscal year following implementation of a policy improving military medical facilities' services, when patients would view the marginal costs of CHAMPUS services to be very much greater than at other times of the year. Therefore it can be expected that any policy changes which would increase military physician accession and retention in a manner that enables reduction in inconvenience costs to patients will likely reduce USHBP total costs and almost certainly will not increase them.

B. FUTURE PREFERENCE ASSESSMENT

In order to predict the relative effectiveness of various policies in improving the system it will be necessary to assess the aggregate relative preferences of patients and physicians for them. The policy attributes have already been discussed. The contrasts are listed here:

patient preference attributes		physician preference attributes
appointment system (reduce inconvenience)		remuneration
choice of physician	⟷	continuity of care
physician availability after-hours	⟷	workload and hours
treatment of family as a unit	⟷	Family Practice residencey and assignment
availability of preventive medical care	⟷	opportunity to practice preventive medicine
		choice of domicile and stability
		opportunity for non-primary care specialization
		occasional requirement to provide primary care

The arrows drawn indicate corresponding preference attributes.

1. Preference Predictions in Demand for Services

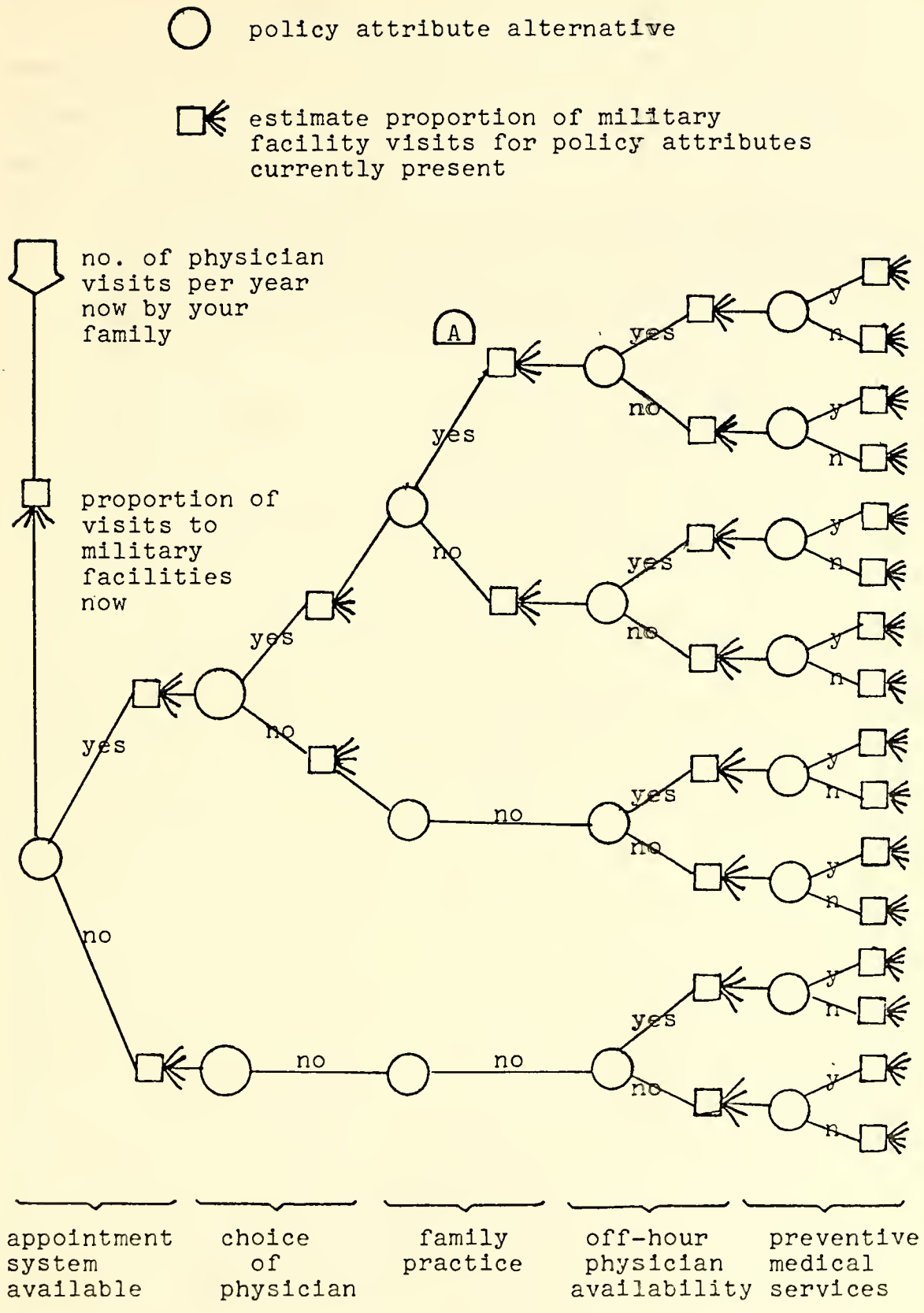
A patient reveals his preference frequently and usually by some proportionality mechanism: i.e. an individual is likely to utilize CHAMPUS part of the time (or for certain services) and to utilize military medical services the rest of the time. It would then be appropriate to ask a patient to express his preferences in terms of the proportion of his visits that would be to military medical care facilities under various policy alternatives. (This is approximately equivalent to the pi-BRLT or lottery reference scheme in Raiffa [1968] or the insurance equivalence schemes.)

To simplify the assessment, only five proportionality options are provided at each step. The sequence of attributes listed is chosen to minimize endpoints, i.e. it would be unlikely that choice of military physician could be provided without instituting an appointment system; Family Practice medicine necessitates choice of physician, and so on.

The format of the decision tree [Raiffa, 1968] is used with substantial modification. The usual decision tree formulation represents a chronological sequence of choices to be made by the preference maximizer. Each choice has some probability distribution of outcomes, each outcome realization with a preference associated. The decision-maker (the preference maximizer) is presumed to find it relatively easy to assign preference values or equivalents to each node independent of other nodes, but finds it relatively difficult to assign cumulative preferences along a branch through several nodes. Thus the solution procedure amounts to formulating a reference preference measure incorporating willingness to accept varying risks, expressing the decision at each node in terms of the reference measure, and then calculating the value of each end point of the tree in terms of the reference measure to enable direct preference valuations so that a most preferred branch (strategy or policy) can be identified. If the decision trees used here are considered in the aggregate, the node probability distributions become preference measure frequency distributions.

The respondents in this decision tree formulation are presumed to find it easy to estimate cumulative preferences along a branch but could not make reliable preference estimates or predictions for nodes independent of the branch context. The decision trees developed here retain the properties of preference distribution at nodes in the aggregate and endpoints of the trees represent preference values under various policies (strategies). Risk of the various policies is not assessed (or meaningful) during the preference valuations, but it is accessible as a dispersion measure of the various end-node aggregate preference responses. The sequence of choices may be viewed as chronological since the assessment questionnaire will present them to the respondent in order along each branch. Most important, the decision tree formulation facilitates expressing the various policy alternatives in a coherent fashion.

The demand for services decision tree requires thirty proportionality estimates by the respondent (a patient) to assess his relative preferences for all relevant policies. The decision tree has the following form:


policy attribute alternative
estimate proportion of military facility visits for policy attributes currently present
no. of physician visits per year now by your family
proportion of visits to military facilities now
A
yes
no
y
n
appointment system available
choice of physician
family practice
off-hour physician availability
preventive medical services

The questionnaire would be a series of thirty-two questions, tracing out each branch of the decision tree shown above. A sample question, representing the assessment made at (A) above would be:

5. Suppose dispensary visits could be made by appointment, and your family had its choice among the physicians available to deal with all of your family's general medical care needs. What portion of your visits to a doctor would be to the dispensary?

   ☐ none

   ☐ a fourth

   ☐ half

   ☐ three-fourths

   ☐ all.

Now denote the value of the j^{th} respondent's answer to the first question as v_j and the second as x_{0j}; denote the (decimal) values of the remaining answers x_{ij} with i=1 for the third question and so on. Then use v_j to weight the answers to cause the actual questionnaire to approximate each patient completing a hypothetical questionnaire prior to each visit to a physician, asking for the probability of utilizing a military medical care source instead of the estimated cumulative realizations. Then for the i^{th} of the sixteen policies (note that the policy at (A) with no further attributes is the same as the fourth endpoint from the top), the weighted value of the j^{th} respondent's predicted preference assessment is $v_j x_{0j}$. If the questionnaire were administered to n patients then the aggregate preference

value for the i^{th} policy would be $\Sigma_{j=1}^{n} v_j x_{ij}$. If a representative or properly randomized sample of n patients comprising s(100)% of the patients nearest a particular military medical care facility is administered the questionnaire, and the total number of patient visits for the preceding quarter was v_t, then $4v_t/s$ is an approximation of the true value of $\Sigma_{j=1}^{n} v_j x_{0j}$ and the value of $(4v_t/s)/(\Sigma_{j=1}^{n} v_j x_{0j})$ could loosely be used as an approximate calibration factor to apply to the i^{th} of the sixteen (renumbered) distinct policy outcome predictions, $\Sigma_{j=1}^{n} v_j x_{ij}$. The unreliability of this calibrated value to predict actual realized demand response under the various policies will be discussed later.

A measure of dispersion of the preference assessments could be obtained as follows:

Let $c_{ij} = (x_{ij} - x_{0j})$ be the predicted change in the proportion of annual number of visits to a military medical care facility by memebers of the j^{th} respondent's family if policy i is implemented;

let f_{ik} be the sum of v_j for responses under policy i which have the k^{th} value of c_{ij}.

Let y_k be these ordered values, with (for example) $y_1 = -1.0$, $y_2 = -0.75$ and so on to $y_9 = 1.0$. Then the dispersion measure would be $\Sigma_{k=1}^{9} y_k^2 f_{ik}$. Note that this is not a variance estimate. It could be given the properties of a variance estimate if it were multiplied by $1/(\Sigma_{k=1}^{9} f_{ik})^2$ and could properly be called the second central moment of proportional predicted preference assessment change under

the i^{th} policy. It could even be calibrated; the calibrated second central moment of proportional predicted preference assessment change under the i^{th} policy alternative would be

$$((4v_i/s)/\Sigma_{j=1}^{n} v_j x_{0j}))^2 (1/\Sigma_{k=1}^{9} f_{ik})^2 \Sigma_{k=1}^{9} y_k^2 f_{ik} .$$

For this to be considered a variance estimate, c_{ij} would have to be considered a realization on a random variable. The interpretation of utility assessments and changes in them as random variables is considered irrelevant by some [in Raiffa, 1968, the argument is offered that the distributions need not be considered and only the expected values are relevant to ultimate choices] but valid by others [as discussed in Barnett, 1973]. The fact remains that if it is a variance estimate, it is only the estimated variance of an assessment of future preference and then only if the calibrated preference assessment statistic is chosen so that the estimate of the mean is

$$((4v_i/s)/\Sigma_{j=1}^{n} v_j x_{0j})(1/\Sigma_{k=1}^{9} f_{ik}) \Sigma_{k=1}^{9} y_k f_{ik} .$$

The usefulness of this dispersion measure is only relative: if its value is larger for one policy than another, it would indicate that the assessment for that policy is less certain in the aggregate. Again, these assessments are implicitly of preferences or utilities, and they should not be interpreted as quantitative behavioral predictions.

2. Preference Predictions in Supply of Services

Conceptually, the assessment of physician preference for various policies proceeds similarly, although no indirect probability assessment can be made since choice in proportionality is not possible. The usual (decision-theoretic) procedure would be to convert each choice into a monetary equivalent (i.e., "I would remain in military medical service under the present policy if I were given an annual bonus of $_____."; "I would remain in military medical service if I were offered the opportunity for a residency in my choice of specialty and an annual bonus of $_____."; and so on). In this policy selection procedure the monetary equivalent methods of assessment are avoided for the following reason: the supply subsystem can be considered as a two sector resource allocation model, physicians and the Bureau of Medicine and Surgery. If a change in policy (which results in retention of physicians who would otherwise leave military medical service) results in a utility gain for one sector (Bureau of Medicine and Surgery, due to increased retention) and a utility loss for another sector (the physicians who were retained by the policy change) and the gainers can compensate the losers so that net gain in utility to both is positive, the welfare of the system as a whole is increased. Aside from the difficulty of ascribing to the Bureau of Medicine and Surgery a marginal utility of money, and the resultant difficulty in deciding if this system's welfare is even relevant to the original objectives, the underlying

qualification usually made to the Kaldor-Hicks criterion [Winch, 1971] is applicable: there must be a reasonable likelihood, as perceived by each sector, that compensation will actually be made, in order for the resulting preference assessments to have any validity. A military physician intending to leave the service would be unlikely to place an accurate monetary valuation on his lack of desire to remain in military service simply because he has no expectation of actually being offered such an extra monetary inducement to retention. (The monetary valuation would be considered accurate if the individual would actually accept it or more and remain in military service if it were actually offered; and he would actually refuse an offer of any less as an inducement to remain in military service, and then would actually leave military service as originally planned.) In fact, under present circumstances, the only way to make such an assessment would be to gain authorization to make such payments and actually pay the bonuses (and contract to offer various of the policy alternatives) to some representative sample of physicians considering leaving military service. The policy attribute "remuneration" was included (among other reasons) in order to determine how often pay is a major factor in military physician retention.

The physician accession and retention decision tree has eight nodal regions with only 49 degenerate branch segments; thus there are 144 endpoints and 207 questions. (The degeneracies include: the impossibility of instituting

Family Practice medicine without continuity of care; it is redundant to desire both Family Practice residency and other specialty training; and the requirement to work in a primary care capacity part of the time is irrelevant to a physician desiring to enter Family Practice.) To formulate a questionnaire exhausting all of the relevant attribute combinations would be unwieldy at best. The decision tree is not represented because of its very large size. Instead of evaluating each node the respondent would be asked to formulate his own policies of choice. Two questionnaires are required: one for prospective accessions to military medical service, and the other for those in military service who have not committed themselves to remaining in the service. The differences are, for those not in military service, the relevant features of the present system (including freedom of practice, pay comparability, likely duty stations, working hours and workload, administrative workload and comparability as well as the remainder of the attributes listed. The questionnaire could look like:

A. Do you plan to remain in (enter) military medical service?

☐ 1. yes 2. no 3. undecided

B. If not or undecided, which one of the following

☐ is the major reason?

1. inadequate pay
2. Unable to settle my family permanently in the area of my choice

3. Being required to practice in primary care capacity some of the time
4. Excessive workload, especially off-hours patient calls
5. I plan to remain in the service
6. Other (specify) _____

C. ☐ ☐ Which two of the first four (or last) do you consider most important?

D. ☐ Which of the first four reasons for leaving military medical service do you consider to be least important?

E. ☐ Given the present pay structure, rotation system, workload and hours, and primary care responsibilities, which one of the following would be most likely to induce you to remain in (enter) military medical service?

1. Opportunity for residency and practice in Family Practice Medicine
2. Opportunity for residency in a specialty other than Family Practice
3. Establishment of permanent patient assignment, enabling continuity of care and an appointment system
4. Participation in a preventive medicine program for service members and dependents
5. I plan to leave (not to enter) military medical service regardless
6. I plan to remain in (enter) military medical service regardless

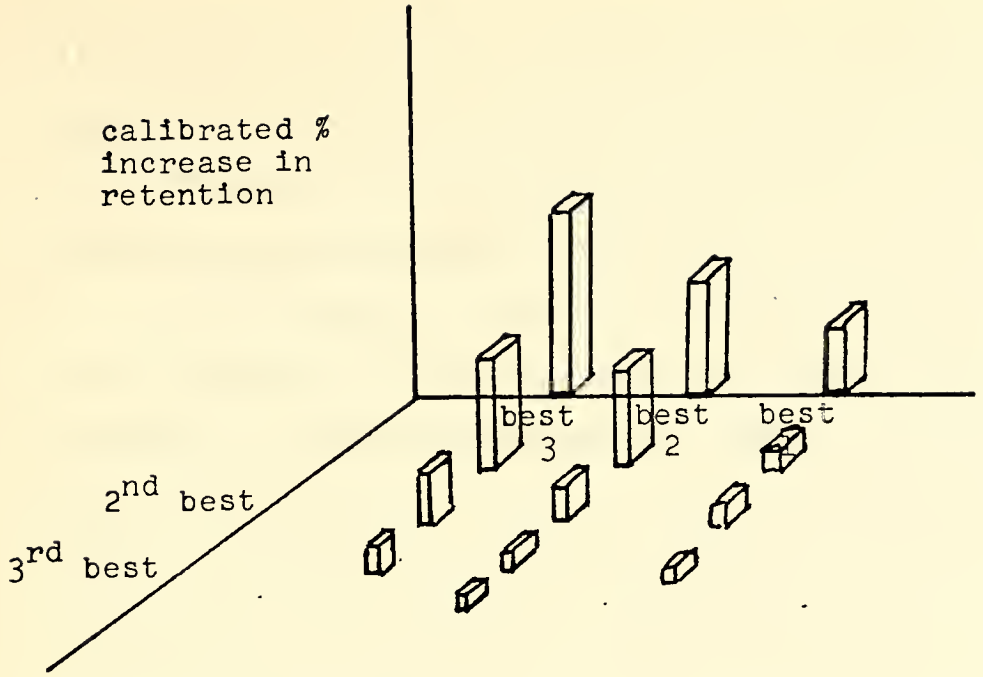
F. Which two of the above would most likely induce you
☐ to remain in (enter) military medical service?
☐ (Enter the same number in both boxes if response 5.
or 6. is selected.)

G. Which three of the above would most likely induce
☐ you to remain in (enter) military medical service?
☐ (Enter the same number in all three boxes if response
☐ 5. or 6. is selected.)

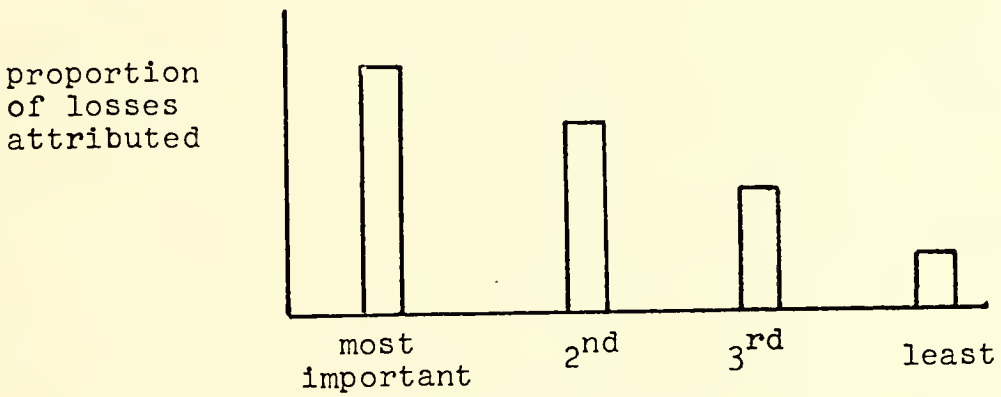
H. Would all of the first four induce you to remain in
☐ (enter) military medical service?

1. yes 2. no 3. undecided

Summary data would then consist in the rankings of responses under B., C., and D., and the ranking of responses under E., F., and G., for those respondents who indicated intention to leave (not enter) military medical service (or undecided) on question A., then calibrating by checking retention rate indicated under A. against recent retention rate. (For accessions, check against accessions to all services.) A two-way preference lattice can then be formulated, with calibrated retention preference predictions represented as the ordinate:



As a side issue (except for the response 4. under B.) a comparable dissatisfaction chart could be prepared:



Note that the retention summary data can be simplified, by counting the total number of occurrences of each of the numbers 1. through 4. under questions E., F., and G. from respondents who did not answer "yes" to question A. The two-way chart's value is in comparing for effects of non-independence of attributes (as Keeney [1969] does mathematically in a slightly different context); in particular, except for the mutual exclusiveness of responses 1. and 2.

it is expected for any combination of attributes not including the single most preferred attribute to be chosen less often than the same number of attributes including the single most preferred attribute.

The category "other" is included solely to avoid the appearance of dictating to the respondent which sources of dissatisfaction he may have. Although the fourth attribute under B. (excessive workload) is not directly included in the policy assessment model, its relative value in decreasing retention is significant to overall policy choice because of its relevance to the "off-hours availability of a physician" attribute to preference predictions in demand for services; any consideration of policies that are based on patient preference for off-hours availability of a physician should explicitly consider the feasibility of maintaining services demanded if physician response indicates that workload and hours is a significant decrement to retention.

Again it must be remembered that the calibrated numbers calculated do not represent good estimates of retention or accession rates that would be achieved after implementation of the various policies; the underlying principle employed is still prediction of preference or utility.

Any measures of dispersion or other statistics within each policy group of equal numbers of attributes would not be especially useful because the random variable underlying is one of discrete order only. Order statistics

of discrete finite random variables can be developed (usually from an equally likely hypothesis rather than a Bayesian prior), but they are not particularly powerful. (An interesting development of this sort of analysis has been made by T. D. Burnett and D. R. Barr of the Naval Postgraduate School in an unpublished paper entitled, "A Nonparametric Analogy of Analysis of Covariance.") About as much useful information as the statistical analysis could provide (perhaps more) is available in the two pictorial representations of retention incentive rankings or in corresponding tables of values with numbers of attributes as the column index, order rank as row index, and preference predictions in retention change as cell entries. Of course separate representations for retention and accession would have to be prepared for consideration.

C. MODELS FOR COMPARISON OF POLICY ALTERNATIVES

1. The Perfect and Continuous Information Model

Suppose that each of the five demand attributes, the corresponding four supply attributes, and the remaining four supply attributes could be implemented at any level (from none to total) and that time, resources, and techniques allowed perfectly continuous, consistent, and complete preference assessments of all levels of all appropriate combinations of the attributes. Suppose further that it was possible to calibrate each in such a way that equal proportions of supply and demand increase would allow the

system to operate at the same patient visit per day per physician ratios as now obtain (hopefully with better effect, with reallocation of physicians to primary care positions). The preference (utility) map would then be a nine-dimension hyperspace with hypersurfaces of equal supply and distinct hypersurfaces of equal demand. Alternately, it could be represented as a ten-dimension hyperspace with the tenth axis as a common supply and demand increment axis. Naturally projections of the supply hyperplane onto subspaces including only demand variables would appear as a constant and conversely for projections of demand onto supply subspace; and because of lack of independence between some of the attributes (as discussed earlier) some of the axis hyperplanes may be vacant. Nevertheless, because each attribute is simple (i.e. its utility is either strictly nonincreasing or nondecreasing with quantity, and the nonincreasing attributes can be converted to nondecreasing ones by appropriate complementation) the surfaces will both be at least quasi-concave with respect to the various half-lines, quadrants, octants, etc. although it is not guaranteed in the full space. Note that this condition does not guarantee that any of the surfaces will intersect anywhere. Now include the variability of response due to aggregation (also perfectly and continuously described). The surfaces become regions of preference density with the expected values forming the surfaces. The regions will have a (hyper-) volume of intersection with probability 1. Any point in a

region of intersection then represents feasibility (supply and demand realizations will be equal) with some finite probability. Referring to the earlier discussion of supply and demand of services where feasible equilibrium conditions were achievable both from increased and decreased supply conditions with respect to the existing system, a positive probability of feasibility is expected almost everywhere in the perfect and continuous information space. The problem remains to find optimal feasibility. Unfortunately the cost of assessing reasonably good approximations of this continuous information model would be enormous. Each respondent would be required to answer hundreds, perhaps thousands of questions; and the sheer size of the questionnaire would discourage thoughtful replies. Further, the additional time required to perform such an assessment over a representative sample of respondents would give rise to confounding with time-dependent uncontrolled variables between responses early in the survey effort and those completed later.

It is tempting to try to formulate all of these models in terms of a higher dimension Edgeworth box model since overall considerations of the problem include allocation of resources between two sectors of a system, preference maximization of two communities, and so on.

The Edgeworth box is used to show the effect on sector utility and total welfare of various divisions of resources (utility attributes) between the sectors. Here, the sectors do not have identifiable utility aggregates;

the allocation of resources here is an effect, not a cause of various utility (preference) changes. Implicitly in Edgeworth box terms, the present problem is an attempt to change the allocation of resources by increasing the utility gained in aggregate by principals who can identify with either sector; the more users in a particular sector, the more utility attributable to that sector. Thus the Edgeworth box mechanisms still obtain (Kaldor-Hicks criterion, theory of second-best) but in an indirect way.

2. The Actual Information Model

The information actually obtainable using the assessment questionnaires may be represented as an irregular lattice in the hyperspaces discussed, with the points lying somewhere near the expected value hypersurfaces. Each sub-orthant and each axis hyperplane would contain at most one supply and one expected demand point. (Of course each policy under demand assessment was represented by as many as 9 points depending on the statistic chosen). It would be unreasonable to expect that any pair of supply and expected demand points would be collocated; further, since supply and demand are aggregate preference predictions under different subjective time scales, revocability conditions, and points of view, collocation or even close proximity would not be conclusive of optimum, or even representative of final equilibrium under the appropriate attribute vector implementation.

3. Reduction in Dimension

The data summaries shown in the future preference assessment discussion represent various projections and vacant sub-orthant omissions. In the case of the supply assessment, the values of projections to the supply change axis in the ten-dimension model are variously shown by order of magnitude among those of equal numbers of attributes (i.e. the vector (000101010x) has the same number of attributes as the vector (000100110x) with "0" representing attribute exclusion, "1" indicating attribute inclusion and "x" indicating the preference value) and by order of magnitude among the largest of the equi-attribute vectors. The expected values of demand vectors are represented similarly. Given the imperfections and limitations of data, and the difficulty of visualization in hyperspace, the summary data are felt to be as meaningful as the full rank model.

4. Optimization

Clearly, two functions cannot be simultaneously maximized [Hillier and Lieberman, 1967; Hadley, 1962; Hadley, 1964; Karlin, 1959]; that is, the problem statement

maximize: A

subject to: maximize B

and: $A \geq A_o$, $B \geq B_o$

(where A_o, B_o represent present conditions) has no solution. However, if the appropriate convexity conditions obtain, and the objectives are reasonably tractable, a search procedure using each intermediate constraint as the subsequent objective

and each intermediate objective value as the subsequent constraint, might be successful. In the perfect and continuous information model already discussed (the ten-dimension case) where no guarantee of strict feasibility in expectation was given, a modified penalty method might be appropriate, searching alternately along the supply and demand surfaces with some negative function of the distance from the supply surface to the demand surface along the increase in supply and demand axis as the penalty function. This procedure implies (loosely) use of the theory of the second best [Winch, 1971] in that the penalty function is chosen (ideally) so that although neither supply nor demand can be selected at optimum (maximum increase), they will be chosen where the equilibrium after policy implementation will result in maximum wlfare (minimum USHBP costs). In the actual information model, the total number of points to be examined is small enough that they could simply be listed in order of supply increase magnitude and a policy among the best few could be selected according to some estimate of feasibility using the relative preference order of the corresponding demand policy as a guide.

An example of "first-best in expected value" (in contrast to second best optima) would be where an optimal attribute vector in the full space would include the optimal (best) vector in the subspace of supply attributes and the optimal vector in the subspace of demand attributes. This would require four of the components of each of the subvectors

corresponding to the common attributes to be identical in value. While this hypothetical outcome is certainly possible, especially in the actual information model, its occurrence is not so likely that a general optimization procedure could include it as a solution requirement. Again, a more general solution procedure must accept solutions of a second-best (in expectation) nature.

In comparing search procedures in the continuous model and the search among points here, it is seen that the continuous model search is guaranteed only to find local optima; and the choice of penalty will determine how "local" rejected optima will be. Thus the optima selected would be very sensitive to penalty selection. The actual information model search amounts to selection among locally optimal points in each of the various-dimensioned subspaces including one in the full space. Thus the search in the continuous model would be better at finding precise local optima but the selection among points in the actual information model would be better at finding a global optimum if it is assumed that the points available are reasonably representative of local optima.

5. Practical Solution Procedures

The summary data for preference predictions suggested consisted in proportional predicted preference changes in demand under each relevant policy (along with a dispersion measure under the policy) and a two-way ranking of proportional predicted preference changes in supply. It was suggested

above that policy choice be based on supply predicted preference ranking with some sort of loose (intuitive) constraint being supplied by requiring that the corresponding demand predicted preference be more than minimal. This is obviously not a consistent decision rule (that is, different decision-makers could choose different policies under this rule). It is at this point that the decision-maker (the level of command in the military medical community which possesses the authority to implement the policies) considers other factors that would result from the policy implementation: short range costs; long range costs; long range effects in limiting future alternative courses of action; and so on. Of course it is prior to this point where such issues as considering the retention effects of "workload" and the patient preference for "off-hours physician availability" attributes are weighed.

6. Interpretations and Limitations

It cannot be emphasized too strongly that the measures predicting future demand preference (patient demand for primary care services) are not expected to be cardinally meaningful as quantitative predictors of patient choice behavior, even after calibration. Their significance lies in the reliability of their ranking by magnitude: a higher magnitude in preference prediction indicates a higher level of utilization behavior if the related policy is implemented. Similarly, measures predicting future supply preference are only meaningful as predictors of relative effectiveness of

the various policies in increasing physician accession and retention.

, The first two positive policy attributes listed under preference predictions in supply of services (opportunity for residency and assignment in Family Practice medicine; opportunity for residency in a specialty other than Family Practice medicine) are mutually exclusive insofar as the respondent is concerned but not insofar as the decision-maker is; although the differences in response can indicate some degree of preference for one or the other, the decision-maker is probably in a position where he can provide both according to the desires and capabilities of the individual respondent. In this case data could be re-summarized, with only three attributes considered instead of four:

(#1 or #2); (#3); (#4) .

It is possible that stronger indicated preference for such a combined policy would result, assisting the decision-maker in defining a clearer choice. As a check, the responses to question H. should have about the same value as the combined preferences for the resummarized data above.

The five negative policy attributes listed under preference predictions in supply of services (remuneration; choice and stability of domicile; part time assignment in a primary care role; excessive workload; other) have not been discussed (except for the relevance of the "excessive workload" measure) because they are not considered variable attributes (at least under the authority of the Chief of

Medicine and Surgery). Although the last-named attribute, "other" should be examined for otherwise unsuspected attributes to decrements in retention it could not be included in the full rank model because of its vagueness; as previously mentioned it was included primarily to improve the palatability of the questionnaire.

These negative and mostly invariable negative policy attributes were included for two reasons: first it is felt that a military respondent would greet any retention questionnaire that did not mention pay and changes of station with great suspicion; second, they could provide an additional data resource in the event policy alternatives relevant to them were discussed at levels of authority above the Bureau of Medicine and Surgery.

V. IMPLEMENTATION AND OUTCOMES

A. IMPLEMENTATION

1. Timeliness of Data

It is fully expected that the results of a study such as is outlined here would be valid only for a relatively short-range prediction. For this reason it is suggested that such a study as is proposed be intended for selection of policy implementation during no more than the following five years. It would be appropriate to structure another study in the intervening years for longer range planning purposes. Locally designed variations to this sort of study could be useful to individual regional medical centers from time to time to select alternatives in local policy. A NRMC Data Processing department could collect and compute the resultant aggregated preferences and calculate the relevant values for use by the cognizant authority using the methods outlined here.

2. Transitions

It is envisioned that any policy alternatives chosen would be implemented gradually; even with the intention of acting in great haste, an organization the size of the Navy's Medical Community cannot reorganize immediately. Beloff [1967], Sloss [1968], and others suggest that an ideal base for community (primary) health care is either the Family Practioner or an Internist and Pediatrician. Thus as an interim measure

the practicability of filling new primary care billets with specialists in Internal Medicine, or Pediatricians is not overlooked. (*)

3. Delays in Effects

Because of the different time scales and frequency of choice that constitute patient and physician behavior, quantitative data for verifying all aspects of behavior response will not be available until several years after implementation is effected. Although patient response may be considered to be immediate because of immediacy of choice available, it has been seen that patient choice behavior is largely a response to the type and quantity of medical care services offered. Thus only intermediate results in patient choice behavior will be available during transition and final patient behavior data will necessarily follow full implementation of medical care supply policies. Fiscal year start confounding will further complicate early assessment. (see page 35.)

B. BEHAVIOR VERIFICATION

1. Patient Demand for Services

This is actually a measure of the direct supply of physician services. Nuisance variables are expected to appear (season of year; pay raises; perturbations in rank structure proportionalities; cost of living index; etc.). Feldstein [1973] suggests that seasonal variation is the largest factor in fluctuations in demands for medical care services. Since the objective was to reduce the proportion

of CHAMPUS utilization in USHBP in favor of increased utilization of the military medical sector, the appropriate statistics could be:

$$\frac{\text{number of military medical services in unit time}}{\text{number of CHAMPUS services in unit time}}$$

and

$$\frac{\text{cost of military medical services in unit time}}{\text{cost of CHAMPUS services in unit time}}$$

The primary motivation for using the ratio (or, if preferred, the inverse) is to suppress the effects of seasonal variation. An appropriate procedure would be to regress the monthly statistics above against time and other appropriate nuisance variables for the year before and the year after implementation; use the regression coefficients in the "before" case to predict values of the statistics chosen during the "after" time period; then use covariance analysis to test for significant differences in predicted values under "no change" conditions and the actual post-implementation values. The alternative hypothesis would be that the statistic under policy implementation is larger than the "no change" prediction. [Johnston, 1972]

2. Physician Supply of Services

The statistics desired concern physician accession and retention in response to policy changes. Because of the delays that will be encountered before changes in policy can have a measurable effect, it might be useful to conduct a

post-implementation preference assessment. Pre- and post-implementation preference assessments of the same individuals may not be meaningful for the following reasons:

(a). Changed circumstances, including entry or departure from military service.

(b). Seeing substantially the same questionnaire, the individual is likely to respond unpredictably: the effects of being re-interviewed are likely to be confounded with actual preference changes in unpredictable ways.

However, if a new questionnaire were formulated specifically asking the respondent to compare his predicted intentions with his actual intentions, the results might be meaningful, at least in terms of the accuracy of the preference prediction assessment methods. Actual behavioral data consists in number of accessions and retention rate. Note that if a large Family Practice residency program is instituted, there is considerable likelihood of a surge in accessions that would confound the effect of other policy attributes. Thus reliable accession rate data would necessarily span several years' time. For retention rate, there are at least two relevant physician populations as in the predicted preference assessment: the physicians in service during policy implementation, and post-implementation accessions. At least four to five years of data would be required to estimate the actual behavior of the latter group (although intent to remain in service or not is usually firmly established within a year or so of end of active obligated

service date). The statistical procedures appropriate would be similar to those for patient behavior except that the seasonal fluctuations would tend to be the result of medical school graduation date rather than weather changes, and ratio data would not be necessary. Because of the smaller data base an alternative method could be a hierarchical design for analysis of variance. [Chapter 7, Kirk, 1968]

In post-implementation analyses of both supply and demand outcomes, an assumption of normality would be reasonable for the regressions, covariance analysis, and analysis of variance, unless preliminary data examination strongly indicates otherwise. The analyses themselves would only indicate whether the policy implemented had had statistically significant effect.

C. INDIRECT REALIZATIONS

If a particular policy is put into effect, the observed behavior (reduction in CHAMPUS use, retention rate) could classically be interpreted as outcomes on a prediction. In this case, however, the difference between the prediction and the subsequent behavior is that one is a predicted preference for a not-yet experienced policy and the other is the behavioral result based on preference established after the implementation. Thus the prediction and outcome can be viewed in a Bayesian sense either as prior and posterior behavior distributions (from the point of view of the person expressing the behavior) or as prior and experimental behavior (as viewed by an outside observer).

1. Revealing Change in Intentions

Because expressed intentions (preferences) and behavior (choices) may not coincide it might be useful to assess current preference after policy implementation. Then the prior distribution is still the preference prediction and the posterior distribution in the post-implementation preference assessment; the sample or experiment is the experience of policy implementation. To estimate the change in attitude brought about by experiencing the policy implementation it would be necessary to invert the process used to find the (Bayesian) posterior distribution in order to estimate the sampling distribution. Although the sampling distribution would be of intrinsic interest to investigate the mechanisms of opinion formation, it is doubtful that the sampling distribution estimated could be used to calibrate preference predictions for different policies or circumstances than those actually encountered.

2. Revealing Intention Effects on Behavior

Either predicted intentions or post-implementation intentions could be considered here; however a simple calibration for estimating the differences between expressed expected preference and actual mean behavior was described under preference predictions in demand for services. If the preference prediction is viewed as a prior distribution and the immediate post-implementation behavior is viewed as an experimental sample, and the two are combined to form a posterior distribution predicting final (long-term) behavior

the implication is that the preference predictions are persistent through policy implementation, and the sample does not represent the final effects of the preference predictions and that in the long run, behavior will have some intermediate distribution. Investigation of this would have some benefit, especially to determine if it is useful for early effects of physician retention behavior.

VI. CONCLUSIONS

A. DIRECT IMPLEMENTATION

The need to respond to increasing patient desire for convenient and sympathetic primary medical care is not contradicted by any information source consulted. Yet implementing all of the policy attributes listed previously might be unnecessary or have unforeseen obstacles or effects. The effects could be established by the study proposed (the preference prediction assessments) and any obstacles are more likely to appear if a study such as this makes policy intentions quite obvious. In addition, the relative simplicity of the methods suggested recommend their use on a smaller scale as may be useful in selecting local NRMC policies.

B. FUTURE VARIATIONS

As major policy changes are implemented, the likelihood is substantial that other dissatisfactions and problems will occur. The general procedures and formulations suggested here should be useful to predict the relative effectiveness of proposed solutions in other problems involving competing system sectors with policy changes possible only in one sector and active participants in the system not competing with either sector or each other.

C. GENERALIZATIONS

American medical practice appears to be moving irreversibly toward increasing government control. The most recent National Health Insurance proposal deleted direct price and quality controls, but trends toward larger group practices, the increasing proportion of physicians in salaried positions, and the increasing acceptance and growth of Health Maintenance Organizations create an increasing incidence of control of cost and methods of medical practice.

The most violent objection to legislation authorizing departures from entrepreneurial medical practice have come from within the medical profession. Threats of boycott and worse were received when group practices were given authorizing legislation decades ago, and were particularly violent at the time of the original MediCare legislation. Yet the concepts of group practice are strongly supported now, Health Maintenance Organizations are gaining acceptance, and majority medical profession support was forthcoming within six months of the effective date of the legislation. In each case, it was observed that the legislative enablements or institutions did not change individual medical practice significantly (except perhaps to assist in stabilizing physician income); there was popular (non-medical) support for each program; the programs or enablements were nation-wide. [Colombotos, 1969] It is therefore reasonable to expect that present trends will continue to meet with resistance from the medical profession, and that they will be well accepted if implemented in a thoughtful manner.

Arguments are offered that insufficient inducements will be available to bright students to enter medical school if increases in government control continue. [Lear, in Evang, Murray, and Lear, 1963] Yet the so-called "Doctor drain" in Great Britain, cited as an example of dire effects of institutionalized medical practice, has decreased steadily since 1951 and medical school applicants have not decreased in number. [Murray, in Evang, Murray, and Lear, 1963]

Overuse of medical care facilities is cited as a certain and undesirable effect of one or another competing forms of institutionalized medicine because of the negligible marginal cost of occasions of service to the patient. Yet the utilization of facilities in the United States (under fee-for-service practice) is about the same as in Great Britain (essentially free services) and is less than in Sweden (which offers free hospitalization but requires proportional co-payments for outpatient care services). It could be safely concluded that the institutional form alone does not determine utilization rate. [Anderson, 1963]

In the near future military medical systems can be expected to evolve into forms resembling the large Health Maintenance Organizations such as Kaiser-Permanente, while civilian practice at large will come to resemble more and more the CHAMPUS system. It appears that both patients and physicians favor third-party (CHAMPUS-type) systems as presently constituted. The difficulties now encountered in third-party systems are increasing costs and the

bureaucratic problems in attempting to hold those costs down. If ways can be found to attract patients away from CHAMPUS sources and into military medical care facilities, and to retain reasonable numbers of physicians at the same time, they will represent a reasonable example of a solution to the acute problem of system response to consumer demand that has heretofore accelerated cost rises and general dissatisfaction with American medical practice. [Garfield, in Chacko, 1971; Feldstein, 1973]

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Some contrasts between civilian and military facility sources of military dependent outpatient medical care sectors of the Uniformed Services Health Benefits Program system are examined. Decreasing the proportion of patient utilization of civilian sources is selected as a system improvement, and increasing military physician accession and retention is seen as a necessary adjunct. Preference as expressed in choice behavior

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is identified as the proximate mechanism in present utilization patterns and is suggested as a predictor for utilization patterns under alternative policies. A method for assessing preference predictions is proposed and selection of an optimal policy discussed. The procedures developed have continuing applicability for policy selection to meet other goals. Policies that improve the system are seen to have applicability to the current problems in medical care delivery systems at the national level.